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BRIEF REPORTS

Training Effects on Raven's Progressive Matrices in Young, Middle-Aged, and Elderly Adults

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Previous training studies of fluid intellectual abilities have involved training on either figural relations or induction tasks. In the present study, young, middle-aged, and elderly adults were given training on another measure of fluid ability—Raven's Progressive Matrices. The training involved a strategy-modeling technique that lasted no more than a few minutes. The results indicated that (a) performance on the Raven decreased with increasing age, (b) training significantly improved performance, and (c) the effect of training did not differ as a function of the age or sex of the subjects. Thus, the results indicate that performance on the Raven can be significantly improved in a single, brief training session.

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A consistent finding in research on cognitive development during the adult years is that performance on fluid measures of intellectual ability declines with age. However, it has also been demonstrated that the relatively poor performance of older adults on some of the fluid ability measures can be enhanced with training (e.g., Baltes, Dittmann-Kohli, & Kliegl, 1986; Labouvie-Vief & Gonda, 1976; Plemons, Willis, & Baltes, 1978; Willis, Blieszner, & Baltes, 1981).

Most of the fluid-ability training studies conducted with adults have, however, focused on only two measures of fluid ability—figural relations and induction. These measures do not tap all of the abilities that constitute fluid intelligence. One purpose of this study was to extend the research on training to a third and very important measure of fluid intelligence—Raven's Progressive Matrices.

Most of the fluid-ability training studies that have been conducted with adults have also been limited to investigating the effect of training on older adults. A second purpose of this study was to extend the training to both young and middle-aged adults as well as elderly adults.

In addition, most of the previous fluid training studies have involved training procedures that extended over multiple sessions for a total of 5 or more hours of training. However, there is reason to believe that such extensive training may not be necessary to facilitate fluid performance. Performance on a number of cognitive abilities, other than fluid abilities, has been successfully facilitated with training procedures that lasted only a few minutes (see Denney, 1982, for a review). A third purpose of this study was to determine whether short-term training would also be successful in significantly facilitating performance on a fluid ability. In summary, this study was conducted to determine whether performance on the Raven could be improved with short-term training and whether the training effects differ for young, middle-aged, and elderly adults.

Method

Subjects were community-dwelling adults from two midwestern cities. Twenty men and 20 women were obtained in each of three age groups: 20 to 30, 40 to 50, and 60 to 70. The average level of education in each age group was 14.8, 13.3, and 11.3 years, respectively.

Subjects were tested individually in their homes or in a laboratory setting. They were randomly assigned to either a training condition or a control condition. Subjects in both conditions were given a pretest that consisted of 20 problems taken from Raven's Standard Progressive Matrices and Raven's Advanced Progressive Matrices. Two such 20-item tests were constructed with items that ranged in difficulty from low to high. A preliminary study conducted with college students indicated that the two forms did not differ in difficulty. Half of the subjects in each condition were presented with one form for their pretest, and half were presented with the other.

After the pretest, subjects in the training group were given training on six of the Raven's matrices that also ranged in difficulty from low to high.[1] The training consisted of the experimenter verbalizing her strategy as she solved the first three problems and encouraging the subject to use the same strategy to solve the second three training problems. The strategy involved determining how the stimuli in the matrix changed across rows, then how they changed down columns and, finally, combining the two types of changes to determine which of the stimulus alternatives belonged in the empty cell of the matrix. The subjects in the control condition were presented with the same six matrices to solve but were given no training.

One week after the training session, subjects in both the training and control conditions were given a posttest. For the posttest, subjects were presented with the form of the test that they were not given for their

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[1] None of these six matrices were on either the pretest or the posttest.

pretest. During the pretest, training, and posttest, the matrices were administered without time limits.

Results and Discussion

The dependent variable was the number of matrices correctly solved. The means of these scores are presented in Table 1. A 3 (Age Group) × 2 (Treatment Condition) × 2 (Sex) × 2 (Test Form) analysis of variance was performed on the pretest scores to determine whether there were any initial differences between the treatment groups or the test forms. None of the effects associated with test form or sex were significant. However, since there was a significant Age × Treatment Condition interaction, pretest score was used as a covariate in the subsequent analysis.

A 3 (Age Group) × 2 (Condition) analysis of covariance in which pretest score was used as a covariate (within but not between age groups) was performed on the posttest scores. The adjusted means of these scores are presented in Table 2. There was a significant main effect for age, $F(2, 119) = 92.42$, $p < .001$. Young adults ($M = 17.27$) scored significantly higher than both middle-aged ($M = 15.45$) and older adults ($M = 12.23$), and middle-aged adults scored significantly higher than older adults. Such age differences in performance are consistent with the age differences typically found in research with the Raven.

There was also a significant main effect for treatment condition, $F(1, 119) = 4.22$, $p < .05$. Scores in the training group ($M = 15.30$) were significantly higher than those in the control group ($M = 14.67$). The absence of a significant interaction between age and treatment condition, $F(2, 119) = 0.73$, $p = .49$, indicates that the training effect did not differ as a function of age.

Table 1
Means of the Raven Pretest and Posttest Scores

Age group	Pretest	Posttest
Control condition		
Young	15.95	16.70
Middle-aged	14.90	15.30
Old	11.45	12.00
Training condition		
Young	17.55	17.95
Middle-aged	14.40	15.60
Old	9.55	12.45

Table 2
Adjusted Means of Raven Posttest Scores

Age group	Control	Training
Young	16.70	17.85
Middle-aged	15.30	15.60
Old	12.00	12.45

The results of this study demonstrate that strategy modeling is an effective training method for facilitating performance in young, middle-aged, and elderly subjects. In addition, the results indicate that significant training effects can be obtained in a single training session that lasts only a few minutes. This suggests that the training effects found in previous studies of fluid abilities could have been obtained with less extensive training. However, it is possible that the longer training procedures produced effects that were either greater or longer lasting than those obtained in this study. Further research would be required to answer this question.

References

Baltes, P. B., Dittmann-Kohli, F., & Kliegl, R. (1986). Reserve capacity of the elderly in aging-sensitive tests of fluid intelligence: Replication and extension. *Psychology and Aging, 1,* 172–177.

Denney, N. W. (1982). Aging and cognitive changes. In B. B. Wolman (Ed.), *Handbook of developmental psychology* (pp. 807–827). Englewood Cliffs, NJ: Prentice-Hall.

Labouvie-Vief, G., & Gonda, J. N. (1976). Cognitive strategy training and intellectual performance in the elderly. *Journal of Gerontology, 31,* 327–332.

Plemons, J. K., Willis, S. L., & Baltes, P. B. (1978). Modifiability of fluid intelligence in aging: A short-term longitudinal training approach. *Journal of Gerontology, 33,* 224–231.

Willis, S. L., Blieszner, R., & Baltes, P. B. (1981). Intellectual training research in aging: Modification of performance on the fluid ability of figural relations. *Journal of Educational Psychology, 73,* 41–50.

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